https://doi.org/10.24095/hpcdp.39.4.04

Commentary

Climate change, health and green space co-benefits

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Abstract

We examined two of humanity's present-day challenges, climate change and chronic diseases, in relation to the co-benefits that green spaces provide to human health and the environment. The reduction of several chronic diseases and associated symptoms, including anxiety, obesity and cardiovascular disease, has been associated with the presence of and access to green space. Green spaces also contribute to a number of environmental health benefits and have been shown to reduce the likelihood of flooding, improve air quality and provide cooling and shade. These co-benefits address both the symptoms of several chronic diseases and associated risk factors along with the environmental and health impacts of climate change. This article explores how to maximize the co-benefits of green spaces through two examples of multi-sectoral collaborations. With these two examples, we have provided a model of collective collaboration that aims to address complex issues, such as climate change and chronic diseases, through the common intervention of green spaces.

Keywords: *chronic disease, green space, climate change, ecohealth, public health, co-benefits*

Highlights

- Major chronic diseases, such as cancer, heart disease and diabetes, cause 65% of all deaths in Canada each year.
- The impacts of climate change are being felt throughout the country, including increased occurrence of extreme heat, droughts and floods.
- Protecting, improving and increasing green spaces can help address both of these major issues.
- EcoHealth Ontario is an example of a multi-sectoral partnership that works together to achieve multiple public health, planning and conservation objectives.

Introduction

Globally and locally, humanity is facing two very serious issues that are impacting human health: chronic diseases[1] and climate change.[2] Major chronic diseases, such as cancer, heart disease, and diabetes, cause 65% of all deaths in Canada each year.[1] The impacts of climate change are being felt throughout Canada, including an increased occurrence of extreme weather events, such as extreme heat, droughts, wildfires and floods.[2] The indirect impacts of climate change are also becoming evident by compounding public health issues and threatening gains in population health.[3,4] While these impacts affect everyone, vulnerable populations are disproportionately burdened.[5]

Green spaces (Box 1) present a unique intervention that offers co-benefits to climate change mitigation, adaptation, and human health. The presence of and access to urban green spaces has been shown to reduce the rate and impact of chronic diseases.[6,7] At the same time, green spaces can also help mitigate and improve resilience to climate change and its impacts.[8]

As Box 2 shows, green spaces can promote physical activity, contribute to social interaction and cohesion, increase access to healthy food, and contribute to stress reduction and cognitive restoration.[6-8] Green spaces also improve air quality, create shade, reduce outdoor air temperatures, and decrease the likelihood of flooding.[9-11]

This article outlines current health challenges and climate change threats facing Canadians and how the co-benefits of green space provide a unique opportunity to help mitigate them. It also presents two collaborations, EcoHealth Ontario in Canada and Climate Change Parks in Scotland (United Kingdom), for tackling cross-cutting issues such as climate change, public health, and the environment by promoting green space as an effective and efficient climate change intervention.

Chronic disease and green space

There are four major chronic diseases and about twenty percent of Canadians live with at least one of them.[1] Cancer, cardiovascular disease, diabetes and respiratory disease cause approximately 65% of all deaths in Canada.[1] Additionally, mental health disorders, including depression and anxiety, are the primary cause for workplace disability in Canada.[1] Moreover, 33% of direct health-care expenditures in Canada can be attributed to disorders of the circulatory and respiratory systems, musculoskeletal disorders and mental disorders alone.[19] There are several risk factors associated with a person's risk of having a chronic disease, including level of physical activity, exposure to tobacco smoke and eating habits.[1] For example, 9 out of 10 Canadian children do not meet

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BOX 1
The term green space refers to a diverse range of spaces

What is green space?

There are many types of green spaces, all of which can provide health and climate change mitigation and adaptation benefits. Green space describes what may be referred to as green infrastructure, natural spaces, open space, or engineered green spaces. There are diverse sizes, types and functions of green spaces, including:

- Public spaces such as parks, conservation areas, greenways, trails, urban and rural forests, street trees, community gardens, school grounds, shorelines and ravines; and
- Private and institutional spaces and infrastructure such as gardens, green roofs, green walls, cemeteries, golf courses, and other outdoor spaces.

the recommended level of physical activity.[1] However, these risk factors are modifiable and the presence of, and access to, greenspace can potentially reduce some risk factors leading to chronic diseases.[7]

There is a large body of evidence demonstrating the positive impacts of the presence of, and access to, green spaces on health.[7] Studies suggest that the health benefits of green spaces are realized through various pathways (Box 2). Green spaces have a number of positive impacts on the urban environment which helps human health, including reducing noise, providing shade and cooling and reducing both the likelihood of flooding and air pollution.[9-11] In addition, green spaces can support and facilitate health and well-being by enabling stress alleviation and relaxation, physical activity, improved social interaction, and community cohesiveness.[6-8] Health benefits associated with the presence of, and access to, greenspace include improved levels of mental health, physical fitness, cognitive and immune function, as well as lower mortality rates.[12,13]

The health benefits of green space are particularly substantial in populations that experience health inequities.[16] For example, a study conducted in England found that for all-cause and circulatory disease mortality, income-related inequalities between the lowest and highest income deprivation groups were lower among those living in the most green areas compared to the least green areas.[16]

A similar finding was described in a Toronto study, which looked at tree density and self-reported health and cardiometabolic conditions. It was found that the presence of trees could significantly improve health perception, comparable to living in a neighborhood with $10 000 higher median income or being 7 years younger.[20]

Green space can increase resilience to climate change

As Boxes 2 and 3 show, the presence of green spaces helps mitigate climate change and improve human health by reducing chronic disease risk factors. But green space also provides the co-benefits of improving resiliency and recovery from the impacts of climate change (Box 3).[21,22]

An example of how the presence of, and access to, green space provides co-benefits is flooding. Flooding related to climate change is increasing and the presence of green spaces can reduce the likelihood of damage due to and extent of flooding. Green spaces such as parks, bio swales, rain gardens, engineered wetlands, and fields within the flood plain have the potential to temporarily store storm water and reduce run-off.[2] At the same time the presence of, and access to, green spaces has the potential to help reduce mental health symptoms, such as stress and anxiety,[6] which can be exacerbated by experiencing a flood.[23] The Intact Centre on Climate Adaptation estimated that "three years after their home was flooded 48 per cent of respondents from flooded households were worried when it rained, compared to three percent of respondents from non-flooded households."[23]

Putting green space evidence into practice through multi-sectoral collaborations

Protecting, promoting and increasing green spaces can be beneficial to human health through: 1) reducing certain chronic diseases and associated risk factors; 2) helping to mitigate climate change impacts; and 3) contributing to increased resiliency for recovering from climate change impacts.[9-11] These issues are being addressed by many different sectors, from public health officials, to urban planners, to conservationists. Protecting, promoting, and increasing green spaces then provides an intersection for a variety of sectors to come together, collaborate, and achieve greater action as a group. The umbrella of green spaces allows very different sectors to come together under one intervention and to maximize the co-benefits provided by green spaces. Two examples of these types of successful collaborations that promote green space are EcoHealth Ontario in Canada and Climate Change Parks in Scotland.

EcoHealth Ontario is a multi-sectoral, collaborative group that leverages mutually reinforcing activities under the vision that protecting, promoting, and increasing green spaces can be beneficial to human health. The collaboration has hosted several multi-sectoral workshops that allow planners, public health officials, conservationists, among others, to discuss methods, tools, and strategies that can help professionals put green space interventions into action. The collaboration also produces reports, toolkits, and education materials that focuses on promoting the ecological, health, and wellbeing benefits of greenspace, including climate change mitigation and adaptation and chronic disease reduction.

Another example of a multi-sectoral collaboration focusing on the co-benefits of green space is the pioneering 'climate change parks' being developed in Scotland. This initiative works by retrofitting existing urban green spaces to deliver climate change solutions.[24] It identifies how the various elements of a park can be modified to have a low carbon footprint and adapt to the weather impacts of climate change, such as providing flood management and shade, and to make the green spaces enjoyable in a variety of conditions.[24]

Conclusion

Protecting, promoting, increasing, and improving green spaces is one intervention that provides several co-benefits to some of the major issues facing communities today. Focusing on green space provides a unique opportunity for groups to apply a single intervention with multiple benefits for multiple stakeholders. The

BOX 2
Co-benefits and modifiers of green space impacts on climate change and human health

Green space impact on health and environment

The presence of and access to green spaces have positive associations with factors related to the environment and human health[6].

Green space associations with the environment[9-11]	Green space associations with human health and wellbeing[6-8]
• Air quality improvements • Reduction in urban heat island, shade provision • Flooding mitigation through storm water storage • Noise reduction • Provision of food	When people have access to local, neighbourhood green spaces: • Birth outcomes are improved • Mortality from all causes is reduced • Level of obesity is reduced • Number of people with cardiovascular diseases is reduced • Symptoms of mental illness, including depression and anxiety are improved • Self-reported feelings of stress are reduced • Social cohesion is improved

Factors that impact the benefits that green spaces provide

Green space characteristics

- Availability and accessibility, e.g. location, distance from residence, quantity, size[12,13]
- Aesthetic, e.g. landscaping, quality perception[13]
- Amenities/equipment, e.g. infrastructure, services[14]
- Maintenance, e.g. regularity of maintenance, garbage removal[15]

Green spaces that are near residences, accessible, and useable for a diversity of groups, and perceived as well maintained have been found to provide the greatest health impacts.[7]

Populations[7]

Vulnerable groups, including people living on low income, racialized groups, older adults, and children have been found to experience the most benefits from green space.[16] In particular, the health of children has been shown to be positively impacted when well-maintained parks with playgrounds are in close proximity to their residence.[17] The health of vulnerable groups has been shown to experience the benefits of green space even with fairly small increases in nearby green space density.[18]

BOX 3
Climate change impacts on human health and the accompanying green space co-benefit

Health impacts from climate change	Green space co-benefit/mitigation
Illness and premature death from exposure to extreme heat[2,5]	• Provides shade[11] • Reduces heat island effect[11]
Illness, stress and premature death from exposure to flooding[2,10]	• Reduces likelihood of flooding through decreased run-off[21]
Mental stress from the impacts of extreme weather[2]	• Reduces stress, anxiety and depression, common symptoms experienced after a flood[23]
Food insecurity[5]	• Community gardens provide local food source[7]
Cardiovascular and respiratory illness due to degraded air quality[3]	• Improve air quality[9] • Lowers rate of cardiovascular disease[8]

benefits of green space provide an opportunity to both protect and promote these spaces, especially in urban centres.

It is imperative that governments, groups, organizations, and businesses work together towards a common goal, especially when addressing complex issues. Multi-sectoral collaboration is a valuable way to maximize the co-benefits provided by green space.

Working together to make green spaces a priority in communities and surrounding areas will help towards addressing the issues of chronic disease and climate change.

Conflicts of interest

The authors declare no conflicts of interest.

Authors' contributions and statement

MK contributed to the study concept and design and writing of the manuscript. EcoHealth Ontario members informed the concept and design and critically revised the manuscript and approved the version submitted for consideration.

The content and views expressed in this article are those of the authors and do not necessarily reflect those of the Government of Canada.

References

1. Public Health Agency of Canada. How healthy are Canadians? [Internet]. Ottawa (ON): Public Health Agency of Canada; 2016. Available from: https://www.canada.ca/en/public-health/services/publications/healthy-living/how-healthy-canadians.html

2. Government of Canada. Canada in a changing climate: sector perspectives on impacts and adaptation [Internet]. Ottawa (ON): Natural Resources Canada; 2014. Available from: https://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/earthsciences/pdf/assess/2014/pdf/Full-Report_Eng.pdf

3. Watts N, Amann M, Arnell N, et al. The 2018 report of the Lancet Countdown on health and climate change: shaping the health of nations for centuries to come. The Lancet. 2018;392(10163):2479-514.

4. Watts N, Adger W, Agnolucci P, et al. Health and climate change: policy responses to protect public health. The Lancet. 2015;386(10006):1861-914.

5. Intergovernmental Panel on Climate Change (IPCC). Global warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty [Internet]. Switzerland: World Meteorological Organization; 2018. Available from: http://www.ipcc.ch/report/sr15/

6. James P, Banay R, Hart J, Laden F. A review of the health benefits of greenness. Current Epidemiology Reports. 2015;2(2):131-42.

7. Toronto Public Health. Green City: why nature matters to health – an evidence review [Internet]. Toronto: Toronto Public Health; 2015. Available from: https://www.toronto.ca/legdocs/mmis/2015/hl/bgrd/backgroundfile-83421.pdf

8. Sandifer P, Sutton-Grier A, Ward B. Exploring connections among nature, biodiversity, ecosystem services, and human health and well-being: opportunities to enhance health and biodiversity conservation. Ecosystem Services. 2015;12:1-15.

9. Nowak D, Hirabayashi S, Bodine A, Greenfield E. Tree and forest effects on air quality and human health in the United States. Environ Pollut. 2014;193:119-29.

10. Depietri Y, Renaud F, Kallis G. Heat waves and floods in urban areas: a policy-oriented review of ecosystem services. Sustainability Science. 2011;7(1):95-107.

11. Bowler D, Buyung-Ali L, Knight T, Pullin A. Urban greening to cool towns and cities: a systematic review of the empirical evidence. Landsc Urban Plan. 2010;97(3):147-155.

12. Maas J, Verheij R, de Vries S, Spreeuwenberg P, Schellevis F, Groenewegen P. Morbidity is related to a green living environment. J Epidemiol Community Health. 2009;63(12):967-73.

13. de Vries S, van Dillen S, Groenewegen P, Spreeuwenberg P. Streetscape greenery and health: stress, social cohesion and physical activity as mediators. Soc Sci Med. 2013;94:26-33.

14. Anthamatten P, Brink L, Lampe S, Greenwood E, Kingston B, Nigg C. An assessment of schoolyard renovation strategies to encourage children's physical activity. Int J Behav Nutr Phys Act. 2011;8(1):27.

15. Maas J, Verheij R, Spreeuwenberg P, Groenewegen P. Physical activity as a possible mechanism behind the relationship between green space and health: a multilevel analysis. BMC Public Health. 2008;8(1):206.

16. Mitchell R, Popham F. Effect of exposure to natural environment on health inequalities: an observational population study. The Lancet. 2008;372(9650):1655-60.

17. Potwarka L, Kaczynski A, Flack A. Places to play: association of park space and facilities with healthy weight status among children. J Community Health. 2008;33(5):344-50.

18. Mitchell R, Richardson E, Shortt N, Pearce J. Neighborhood environments and socioeconomic inequalities in mental well-being. Am J Prev Med. 2015;49(1):80-4.

19. Public Health Agency of Canada. Economic Burden of Illness in Canada, 2010 [Internet]. Ottawa (ON): Public Health Agency of Canada; 2017. Available from: https://www.canada.ca/content/dam/phac-aspc/documents/services/publications/science-research/economic-burden-illness-canada-2010/economic-burden-illness-canada-2010.pdf

20. Kardan O, Gozdyra P, Misic B, et al. Neighborhood greenspace and health in a large urban center. Sci Rep. 2015;5(1):11610. doi: 10.1038/srep11610.

21. European Environment Agency. Urban adaptation to climate change in Europe: challenges and opportunities for cities together with supportive national and European policies [Internet]. Copenhagen (Denmark): Office for Official Publications of the European Union; 2012. Available from: https://www.eea.europa.eu/publications/urban-adaptation-to-climate-change

22. World Health Organization (WHO). Urban green spaces and health: a review of evidence [Internet]. Copenhagen (Denmark): WHO Regional Office for Europe; 2016. Available from: http://www.euro.who.int/__data/assets/pdf_file/0005/321971/Urban-green-spaces-and-health-review-evidence.pdf?ua = 1

23. Decent D, Feltmate B. After the flood: the impact of climate change on mental health and lost time from work [Internet]. Waterloo (ON): Intact Centre on Climate Adaptation; 2018. Available from: https://www.intactcentreclimateadaptation.ca/wp-content/uploads/2018/06/After-The-Flood.pdf

24. greenspace scotland. Retrofitting urban parks to deliver climate change actions [Internet]. Stirling (Scotland): greenspace scotland; 2012. Available from: https://drive.google.com/file/d/1rWuEtaHSF21rUOxW9hVzAgRVUnq-ZdY7/view